Master's Thesis of Psychology

Effects of Affect and Numeracy on Attractiveness Judgment

정서와 수리력의 상호작용이 매력도 판단에 미치는 영향: 대상 관련 정서, 부수적 정서와 수리력의 상호작용을 중심으로

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Abstract

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It is widely accepted that both cognition and affect have a powerful influence on our judgment and decision-making. However, the ways that different types of affect interact with cognition and how those interactions influence our judgment and decision-making deserve further investigation. In this study, affect was categorized depending on its relevance to the judgment at hand: integral affect (affect relevant to the current judgment) and incidental affect (affect irrelevant to the current judgment). This categorization was used to investigate how two types of affect differentially interact with numeracy, the cognitive ability to process probabilistic and numeric information. It was also examined how the interactions between two types of affect and numeracy have different influences on attractiveness judgment.

For this investigation, an adapted attractiveness judgment task was used where participants were asked to evaluate the attractiveness of a simple gamble (Slovic et al., 2002) with two different conditions (with a loss vs. without a loss). Previous studies that used this judgment task have shown: 1) the gamble with a loss was evaluated to be more attractive than the one without a loss, and this effect was mediated by how people felt about the gamble (i.e., integral affect), 2) higher numeracy increases the effect of integral affect and decreases the biasing effect of incidental affect. Based on these findings, some researchers suggested an integrative model of integral and incidental affect where incidental affect has a larger influence on judgment when integral affect is less intense or precise. Therefore, I hypothesized: 1) participants who have more positive integral affect about

the gamble would rate it more attractive than participants who have less positive integral affect. Also, this effect would be moderated by the numeracy level of participants, 2) participants who are induced to have positive incidental affect irrelevant to the gamble would rate it more attractive than participants who have negative incidental affect. Also, this effect would be moderated by the numeracy level of participants, 3) participants who feel more positively about the gamble would be less influenced by the experimentally induced incidental affect in making the attractiveness judgment. The aforementioned judgment task was used to directly manipulate integral affect and listening to affective sound stimuli to manipulate incidental affect.

The results from Study 1 and 2 indicate that, with higher numeracy, the effect of integral affect on the attractiveness judgment increased, while the effect of incidental affect on the attractiveness judgment decreased. These results imply that the ability to process relevant information and the presentation of information about an object to judge (i.e., the presence of a potential loss, which can either make potential gains look more favorable in comparison) changes the way affect influences the judgment process. The current findings provide novel insight into distinguishing the effect of integral and incidental affect on attractiveness judgment and their interaction with numeracy. The implication of future research on delineating the differential influences of integral affect and incidental affect on judgment and decision-making was discussed.

Keyword: affect-cognition interaction, integral affect and incidental affect, numeracy, judgment, and decision-making

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Chapter 1. Introduction

For a long time, judgment and decision making were largely seen as cognitive processes. Therefore, the research in judgment and decision-making has focused heavily on cognition rather than affect. The critical role that affect plays, however, has started to receive its long-due attention, with the past decade even called "the emotions revolution" (Västfjäll & Slovic, 2013; Weber & Johnson, 2009). The empirical evidence that shows affect is indeed an integral part of judgment and decision making has come out from various academic domains including psychology, economics, consumer research. Therefore, it is very timely to further investigate how affect influences our judgment and decision-making processes and delineate its nuanced role in different contexts.

Although it is no longer a question that affect has a significant influence on judgment and decision making, the question of how affect and cognition interact and how that interaction influences judgment and decision-making still remains a difficult one to answer. Thus, it is also difficult to discern whether affect harms or helps the processes of judgment and decision making. The aim of the current study is to contribute to answering these questions.

Researchers have consistently disagreed on whether affect improves or impairs the decision-making processes (Baumeister et al., 2007) and the existing literature diverges largely in two directions. One line of research shows that information we derive from our affective experiences is as essential in judgment and decision-making as the information we derive from cognitive processes. To illustrate, in his research with brain-damaged patients whose ability to process affect was impaired, Damasio (1994) showed that the patients with lesions in the orbitofrontal cortex

was not able to make rational decisions beneficial to themselves. In other words, it was not their cognitive abilities that impaired their ability to make decisions, but the ability to feel. Here, the ability to feel more specifically refers to the ability to associate affective experiences (i.e., feelings and emotions[①]) with actions. The other line of research demonstrates that affect keeps people from making rational and beneficial decisions for themselves. For instance, the "mood-as-information" theory (Schwarz & Clore, 1983) explains that people make judgments and decisions partially based on their mood, even though mood is mostly irrelevant to the target of judgment and decision at hand, and therefore, should not be taken into the process of judgment and decision.

Multiple researchers argue that distinguishing different affective experiences could help us to understand these seemingly contradicting results. One of the suggestions is distinguishing between different types of affect depending on its relevance to a given judgment and decision – that is, integral affect and incidental affect. In previous research, the distinction between two types of affect is made by their sources and relevance to judgment and decision-making at hand (Västfjäll et al., 2016), or by the existence of objects relevant to one's current goals (Blanchette & Richards, 2010). Most importantly, their impacts on judgment and decision-making are not equivalent.

① In his book (1994), Damasio defined the terms, feeling and emotions, as follows: 1) emotions as physical states arising from the body's responses to external stimuli (e.g., changes in muscle tone, heart rate, endocrine release, posture, facial expression). 2) feeling, distinguished from emotion, as mental experiences of body states which arise as the brain interprets emotions. These terms are not used in the same manner across the affective science literature. Thus, the definitions of the relevant terms are indicated in *4.2 Definition of terms*.

1 Integral affect and incidental affect

Integral affect refers to affective experiences that directly result from the consideration of a target of a judgment or a decision (Loewenstein & Lerner, 2003). For example, how we feel about various choice options while purchasing a product could be integral affect. In making such a judgment and decision, we can use our affective reactions towards options as proxies for values and use them as information in the evaluation of the options. (Pham, 2007). In this sense, Damasio's findings, referenced above, demonstrated the importance of integral affect by suggesting a failure to integrate information from integral affect into decision-making resulted in a failure to make beneficial decisions. Kahneman and his colleagues (1997) also pointed out that, without affective feelings about the information that needs to be considered to make a judgment, it would be impossible to differentiate good options from bad ones. In other words, our experiences of integral affect allow us to categorize experiences on a good-bad dimension and enable us to reach to a decision.

On the other hand, incidental affect refers to affective experiences whose source is unrelated to a target of a judgment or a decision being made (Cohen et al., 2008). Most research involving affect deals with incidental affect such as mood, priming, motor affect, or affective conditioning (Cohen et al., 2008). Schwarz (2001) demonstrated the effect of incidental affect by showing that affect elicited by irrelevant sources such as weather might also influence judgments of how one perceives the surrounding environments. Lerner, Small, and Lowenstein (2004) showed how much we are willing to pay for the same object could change according to our incidental affective states, induced by irrelevant sources such as a film clip. These results indicate that even though the affective state is unrelated to the target of the judgment, it can influence judgments and decisions (Schwarz & Clore, 2003).

Thus, the distinction between integral and incidental affect helps to better understand the confounding findings about the influence of affect on judgment and decision-making. First, the evidence that affect could be beneficial to judgment and decision-making comes mainly from research studying affect relevant to the target of judgment or decision at hand (i.e., integral affect). By contrast, the evidence that supports the view of affect impairing judgment and decision-making comes mainly from the research studying the influence of affect unrelated to the target (i.e., incidental affect). This research demonstrates that this type affect that should not be taken into consideration in the judgment and decision-making process. Lack of consideration of these differences could be one of the reasons why research findings on the influence of affect on judgment and decision-making diverge. This distinction between integral and incidental affect based on its relevance to judgments and decisions may provide the key to solving the complex influence of affect on these psychological processes.

2 The interaction between integral and incidental affect

In real-life settings, when a judgment or a decision is made, people refer to and are influenced by both integral affect and incidental affect simultaneously. Furthermore, the two types of affect interact with one another, making their differential effects even harder to study. Therefore, it is critical to consider not only the distinction between integral and incidental affect, but also their interactions. In other words, while integral affect and incidental affect have their own determinants and separate effects on judgement, they simultaneously work in tandem to determine the affective reaction to a target (Västfjäll et al., 2016). Specifically, Västfjäll and his collogues (2016) argue that the influence of incidental affect is contingent on the intensity of integral affect. Therefore, a stronger integral affect decreases the effect of incidental affect. However, to the

best of my knowledge, only a few studies have taken this interaction into consideration (Västfjäll et al., 2004), resulting in a lack of empirical investigation on the joint influence of the two types of affect.

One of the studies (Garg, Inman, & Mittal, 2005) examined the interplay between the two types of affect, task-related affect and incidental affect, in consumer choice of a status quo option. Task-related affect is also a type of affect relevant to a judgment and a decision at hand, generated because of the characteristics of the task such as difficulty. In this study, task-related affect was used instead of integral affect and manipulated by different emotional trade-off difficulty. The researchers demonstrated that task-related affect from making emotionally difficult decision increased participants' preference for the status quo option when incidental affect was absent. However, this effect no longer existed when individuals were induced to have incidental affect such as feeling angry or sad. Even though the research showed the interaction between incidental affect and task-related affect, instead of integral affect, the results indicated that it is critical to consider the interaction between affect of different sources in judgment and decision-making research.

Another study found further support for the relationship between integral and incidental affect in the context of charity donation (Västfjäll et al., 2008). The study showed that participants with positive incidental affect decided to donate more money than participants with negative incidental affect, but only when they had more intense integral affect about the target of decision. Except for the aforementioned studies, to my best knowledge, research delineating these interaction effects is scarce.

Unlike task-related affect, as used in the research above, which can be manipulated by changing characteristics of the task (e.g., requiring more cognitive load), it is more difficult to directly manipulate integral affect.

The lack of empirical investigation into the interplay of integral affect and incidental affect may be attributed to this difficulty. Therefore, the current study first sought out a method to directly manipulate integral affect to investigate the contingent relationship between two types of affect and their influence on judgment and decision-making.

3 Previous research

3.1 Effect of integral affect in judgment and decision-making

Slovic and his colleagues (2002) introduced the theory of affect heuristic to explain how people use affective information in their judgments. The affect heuristic refers to a sort of mental shortcut in which people make decisions that are heavily influenced by their current affective states toward a particular stimulus. The researchers introduced a paradigm using a simple gamble to investigate how the affect heuristic is used in attractiveness judgment.

The gamble consisted of the same potential gain, paired with or without a potential loss in two different conditions. One group of participants were asked to judge the attractiveness of a gamble with a 9-dollar gain and no loss ("7/36 chances to win 9 dollars and 29/36 chances to win nothing"; *no-loss condition*). The other group of participants judged the attractiveness of a gamble with the same amount of gain but with a small potential loss of 5 cents ("7/36 chances to win 9 dollars and 29/36 chances to lose 5 cents; *loss condition*). Counterintuitively, the results showed that the mean rating of the attractiveness of the gamble with a loss was significantly higher than that of the gamble without a loss. (M_{loss} = 14.9, $M_{no\text{-}loss}$ = 9.4 on a scale from 0 (not at all attractive) to 20 (extremely attractive)), even though the expected value of the gamble without a loss is higher than that of the gamble with a loss (Table 1). The results remained consistent even after the 5-cent loss was changed to 5-

cent win or an increased loss such as 25 cents (Slovic et al., 2002).

Table 1.
Expected Values and Attractiveness Ratings of Gambles used in Slovic et al. (2002)

	Expected Value	**Mean Attractiveness Rating (on a scale from 0 to 20)**
7/36 win 9 dollars; 29/36 lose nothing (*no-loss condition*)	1.75	9.4
7/36 win 9 dollars; 29/36 lose 5 cents (*loss condition*)	1.71	14.9

Note. Expected values were calculated by the author.

Several researchers (Bateman et al., 2007; Peters et al., 2006; Slovic et al., 2002) interpreted this phenomenon in the context of affect and affective precision. That is, when the same information (i.e., the 9-dollar gain) was presented in an evaluable format (i.e., the comparison between the 9-dollar gain and 5-cent loss), it enabled participants to more precisely map the 9-dollar value onto the attractiveness scale. Accordingly, the affective reactions generated by the 9-dollar gain had more weight in the attractiveness judgment of the gamble than there was no comparison. In other words, the evaluability in the gamble with the 5-cent loss enabled participants to draw a more precise and positive affective reaction to the gamble from the comparison. In contrast, the mapping of the 9-dollar gain alone onto the scale would be less precise, making it more difficult to judge its attractiveness based on absolute value alone. In turn, the difficulty in making the judgment would result in more a negative

affective reaction to the gamble. Therefore, the existence of a potential loss in the gamble would cause participants to feel (i.e., integral affect) more positive about the gamble and in turn, judge more it more attractive, even though the same amount of gain is presented and the expected monetary value is smaller.

3.2 Influence of cognitive ability on integral affect and incidental affect

Using the same attractivenss judgment task, Peters and her colleagues (2006) demonstrated that the affective meaning generated by the gain-loss comparison are different depending on the level of participants' numeracy, which result in different effects on the attractiveness judgment of the gamble. Specifically, people with higher numeracy draw more affective meanings from the numerical comparison of gain and loss than people with lower numeracy do. Even though both of the higher and lower numerate people use their affective experiences as information in their judgment, but they do so from affect of different sources. In their experiment, they showed the higher numerate derived more affective meaning from numerical comparisons between relevant information sources (i.e., integral affect). On the other hand, the lower numerate tended to be influenced by irrelevant sources of affect (i.e., incidental affect) in their judgment and decision making.

Moreover, Västfjäll, Peters, and Starmer (2011) provided further evidence of the differential use of affective information between individuals with different numeracy levels. In this study, researchers asked participants to price a lottery ticket after inducing participants' moods (i.e., incidental affect) using an unrelated recall task. The results showed that the less numerate participants were more influenced by the mood induction than highly numerate participants in pricing the same lottery.

Another study (Traczyk et al., 2018) also demonstrated that the higher numerate individuals are likely to be more sensitive to integral affect, which led them to be more engaged in sampling relevant information to maximize their decision outcomes.

Based on the findings from previous research, I investigated how integral and incidental affect interacted differently with a cognitive ability (i.e., numeracy) and, in turn, have different effects on attractiveness judgment. In order to do so, I adapted the attractive judgment task of the gamble with/without a loss used in the affective heuristic paradigm and utilized it as a manipulation method to induce integral affect about the direct target of the attractiveness judgment – the gamble.

4 Current study

4.1 Objective and Hypotheses

4.1.1 Objective

The current study aimed to examine the following questions: 1) how integral and incidental affect differentially interact with numeracy, the cognitive ability to process probabilistic and numeric information, 2) how the differential interaction effects between integral and incidental affect and numeracy on a task of judging attractiveness of a simple gamble. For the investigation, two studies were conducted. First, I examined whether participating in judging a gamble with different conditions (loss vs. no-loss) could induce different integral affect and therefore, it could be used as a method to manipulate integral affect (Study 1). Second, I examined whether individuals with higher numeracy would use more of information derived from integral affect and less of that derived from incidental affect than individuals with lower numeracy (Study 2). Lastly, I examined whether there is an interaction effect between integral and incidental

affect on the attractiveness judgment of the gamble (Study 2).

4.1.2 Hypotheses

Previous research showed that 1) the gamble with a loss was evaluated to be more attractive than the one without a loss and this effect was mediated by integral affect about the gamble, 2) people with higher numeracy drew more affective meaning from integral affect and used it in their judgment, 3) people with higher numeracy were less affected by incidental affect when making judgments. Based on these previous findings, the following hypothesized model was tested in the current study (Figure 1). The specific hypotheses are as follows.

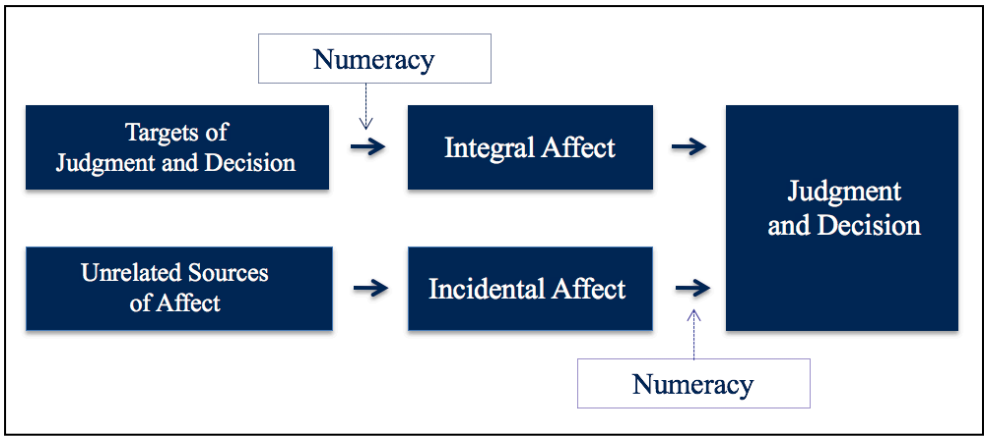

Figure 1. Hypothesized model of the current study

Study 1

Hypothesis 1A: Participants in the condition with a loss (*loss condition*) would feel more positive about the gamble than participants in the condition without a loss (*no-loss condition*)

Hypothesis 1B: Participants in the loss condition would rate the gamble more attractive than participants in the no-loss condition because they feel more positive about it.

Study 2

Hypothesis 2A: Participants who feel more positive about the gamble would rate the gamble more attractive than participants who feel less positive. Also, this effect would be moderated by the numeracy level of participants.

Hypothesis 2B: Participants who are induced to feel positively irrelevant to the gamble would rate the gamble more attractive than participants who are induced to feel negatively. Also, this effect would be moderated by the numeracy level of participants.

Hypothesis 2C: Participants who feel more positive about the gamble would be less influenced by the experimentally induced incidental affect in the attractiveness judgment of the gamble.

4.2 Definition of terms

In the literature, different terms that indicate a range of affective experiences are used interchangeably, such as affect, emotion, feeling, mood, attitude. In the current paper, the meaning of the term, affect, was used limited to valenced affective states of feeling good or bad with arousal and dominance as other factors. Mood, referring to affective states lasting longer than emotion without specific objects, was used only in the literature review, where it was used interchangeably with incidental affect.

4.3 Assumption

The current study only investigated the valence of both integral affect and incidental affect. Therefore, the terms of integral affect and incidental

affect are used only to mean their valence. To indicate another aspect of affect besides valence, I separately indicated it (e.g., as affective precision, the degree of precision to which a certain instance of affect is experienced).

Chapter 2. Study 1

In Study 1, I tested whether participants in the loss condition would judge the gamble more attractive than participants in the no-loss condition. The primary purpose of Study 1 was to confirm differentiating the gamble condition (loss vs. no-loss) could be used to manipulate integral affect participants have about the gamble. Also, in order to replicate the findings of previous studies of the affective heuristic (Bateman et al., 2007; Peters et al., 2006; Slovic et al., 2002), I examined if how participants feel about the gamble (i.e., integral affect) explained the effect of the gamble condition on the attractiveness rating. Therefore, the following hypotheses were tested in Study 1.

Hypothesis 1A: Participants in the loss condition would feel more positive about the gamble than participants in the no-loss condition

Hypothesis 1B: Participants in the loss condition would rate the gamble more attractive than participants in the no-loss condition because they feel more positive about it.

To test the hypotheses above, Study 1 was designed as a one-factor (gamble condition: loss vs. no-loss) between-participant experiment. Participants were randomly assigned to one of the two conditions: rating the gamble with a loss vs. rating the gamble without a loss).

1 Method

1.1 Participants

Forty undergraduate students who took introductory psychology courses at Seoul National University participated in the experiment. They were recruited from a course credit participant pool. The average age was 23 years (*SD = 2.15*), and 17 participants were female.

1.2 Procedures

When they arrived in the laboratory, all participants were first asked to read and sign the first consent form. To avoid hypothesis guessing, participants were told that the current experiment was conducted as a preliminary research to investigate possible factors of individual differences in everyday judgment and decision-making. They were also told that each participant would be randomly assigned to a range of different judgment and decision-making tasks. After they signed the first consent form, they were seated in front of a computer separately. Each seat was compartmented so that participants could not see to which experimental condition other participants were assigned. Once they were seated, they were given a written instruction that they would randomly participate in one of the judgment and decision-making tasks. Then, the description of the gamble that each participant was assigned to was presented on the screen. After reading the description of the gamble, they judged how attractive the gamble and reported how they felt about the gamble. Lastly, they provided demographic information. Once all participants completed the task, they were debriefed with the true research hypothesis. After the debriefing, they were asked if they still agreed with their data to be used for analysis and signed the second consent form once again. The experiment was conducted for 30 minutes.

1.3 Materials and measures

1.3.1 Attractiveness judgment task (Appendix 1)

The attractiveness judgment task was adapted from Slovic et al. (2002) and other previous studies that used the task (Bateman et al., 2007; Peters et al., 2006). The task was translated in Korean, and U.S. dollar in the original task was changed to Korean won (i.e., 9 dollars to 9000 won and 5 cents to 50 won). The task consisted of two conditions. In the loss condition,

participants were asked to rate the attractiveness of the gamble with a 9000-won gain and a 50-won loss. In the no-loss condition, participants were asked to rate the attractiveness of the gamble with the same 9000-won gain without any loss. Participants' judgment was measured by the attractiveness rating on a 21-point Likert scale (from 0 = "Not at all attractive" to 21 = "Extremely attractive").

1.3.2 Integral affect about the gamble (Appendix 5)

Participants were asked to report how they feel about the gamble (i.e., integral affect) and how precise the feeling is (i.e., affective precision), respectively. Integral affect was rated on a 7-point Likert scale (from -3 = "Very negative" to 3 = "Very positive") and affective precision was rated on a 7-point Likert scale (from 0 = "Completely unclear" to 6 = "Completely clear").

2 Results

For analysis, the gamble condition was coded as the no-loss condition = 0 and the loss condition = 1. The responses for integral affect (and its affective precision) about the gamble were coded as from 1 = "Very negative" ("Completely unclear") to 7 = "Very positive" ("Completely clear"). Lastly, the attractiveness ratings of the gamble were coded as from 1 = "Not at all attractive" to 21 = "Extremely attractive." The data of 5 participants were not included in analysis because they failed to report the attractiveness of the gamble and integral affect about the gamble.

2.1 Integral affect about the gamble

In order to check if the gamble condition can be used as a method to manipulate integral affect about the gamble, I first examined if participants in the loss condition felt more positive about the gamble (i.e., integral affect) than participants in the no-loss condition. Participants in the loss

condition reported (*M = 5.38, SD= 1.06*) feeling more positive about the gamble than participants in the no-loss condition (*M = 4.38, SD= 1.96, F(1, 38) = 4.38, $p < .05$, $\eta_p^2 = .103$*; Figure 2). The result indicated that participating in the attractiveness judgment task of the loss or no-loss conditions resulted in a successful manipulation of integral affect about the gamble.

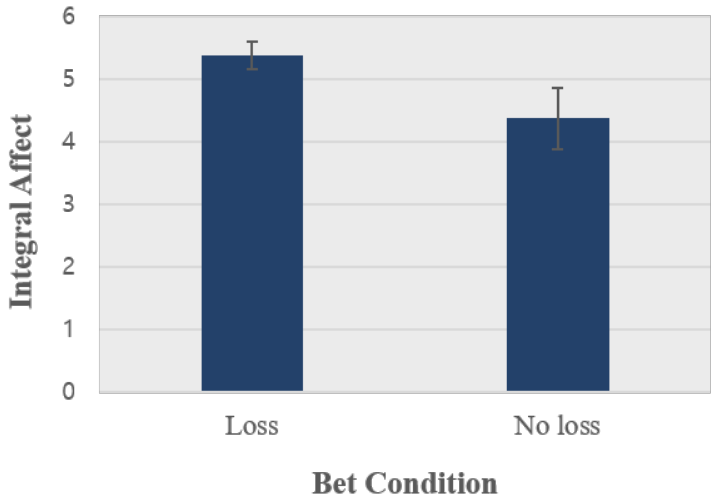

Figure 2. Effect of the two different gamble conditions (loss vs. no-loss) on integral affect about the gamble

2.2 Attractiveness judgment of the gamble

Second, I examined if participants in the loss condition rated the gamble more attractive than participants in the no-loss condition. Participants in the loss condition *(M = 17.50, SD= 4.35*) rated the gamble significantly more attractive about the gamble than in the no-loss condition (*M = 11.16, SD = 7.06, F(1, 38) = 12.52, $p < .01$, $\eta_p^2 = .25$*; Figure 3).

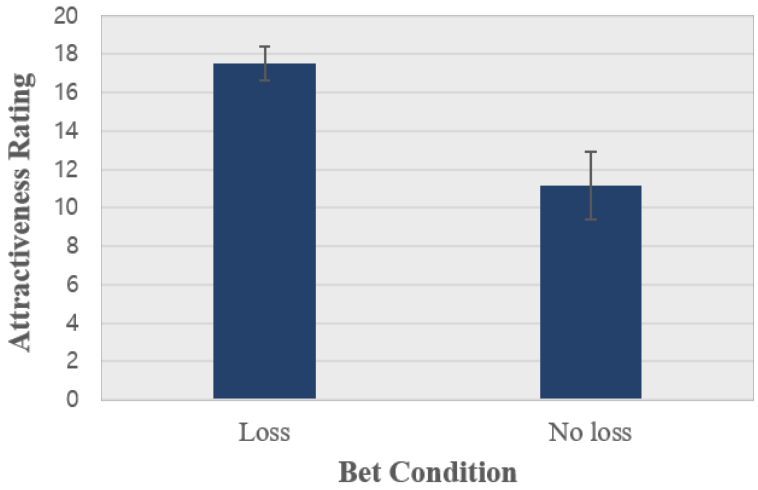

Figure 3. Effect of the gamble condition on the attractiveness rating

Further, I tested if how participants felt about the gamble (i.e., integral affect) mediated the effect of the gamble condition on the attractiveness rating. A mediation PROCESS model with bootstrapping (*Model 4*; Hayes, 2018; Preacher & Hayes, 2004) was used. This method was selected because it does not assume normality of the distribution of indirect effects. I estimated the indirect effect of the gamble condition on the attractiveness rating through integral affect about the gamble with 1000 bootstrapping samples for a 95% confidence interval. This mediation model (Model A) is described in Figure 4.

In Step 1 of the mediation model, the regression of the gamble condition on the attractiveness rating, ignoring the mediator (integral affect about the gamble), was significant ($b = 6.38$, $t(38) = 3.54$, $p < .01$). Step 2 showed that the regression of the gamble condition on the mediator was also significant ($b = 1.00$, $t(38) = 2.09$, $p < .05$). Step 3 showed that the regression of the mediator, controlling for the gamble condition, was also significant, ($b = 3.08$, $t(37) = 8.63$, $p < .001$). Step 4 revealed that,

controlling for the mediator, the gamble condition was still a significant predictor of the attractiveness rating ($b = 3.30$, $t(37) = 2.97$, $p < .01$). These results indicated that how participants felt about the gamble partially mediated the effect of the gamble condition on the attractiveness rating of the gamble.

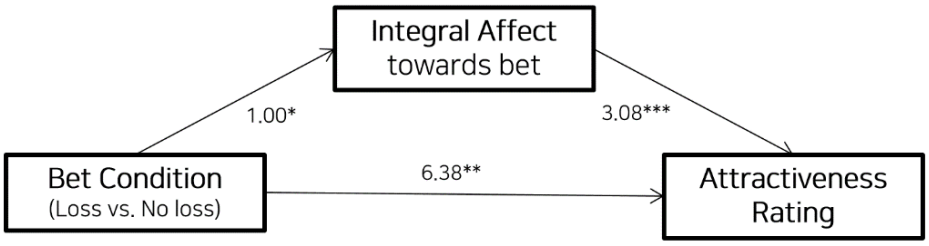

Figure 4. Results from the mediation analysis of Study 1; Asterisks indicate significance (p <.05, ** p < .01, *** p <.001)*

3 Discussion

The results of Study 1 demonstrated that the gamble condition (with a loss vs. without a loss) caused participants to have different integral affect about the gamble. Specifically, participants in the loss condition reported feeling more positive about the gamble than participants in the no-loss condition. Furthermore, I also found an additional evidence that supported the initial findings of the affect heuristic (Slovic et al., 2002). The results indicated that people use how people feel about the target of judgment as a heuristic when making a judgment. Accordingly, the task was used in Study 2 as a manipulation method of integral affect.

Chapter 3. Study 2

Study 1 found that having participants judge the attractiveness of a gamble of two different conditions (i.e., the same gain with or without a loss) can elicit a change in how they felt about the gamble. When judging the attractiveness of the gamble with a loss, people reported feeling more positive about the gamble than when judging that of the gamble without a loss. Based on the results of Study 1, Study 2 was designed to examine the effect of both integral affect (i.e., how participants feel about the gamble) and incidental affect (i.e., how participants feel irrelevant to the gamble) on the attractiveness rating. In this design, integral affect and incidental affect were both directly manipulated. The procedure from Study 1 – having participants rate the attractiveness of the gambles with or without a loss – was used to manipulate integral affect. Incidental affect was manipulated by having participants listen to affective sounds of positive or negative valence.

With such design, Study 2 aimed to investigate the differential interaction between integral and incidental affect, and numeracy, a cognitive ability relevant to processing the numerical information of the gamble. Ultimately, I examined the effects of those interactions on the attractiveness judgment. For integral affect, which is relevant to and derived from a target of a judgment, it is likely to be influenced by the ability to process the information about the target of the judgment at hand. Thus, it can be predicted that people with higher numeracy would have significantly more positive integral affect about the gamble, and in turn, judge it more attractive in the loss condition than in the no-loss condition. This hypothesis is supported by the findings of previous research (Peters et al., 2006; for review, Peters, 2012) that people with higher numeracy drew more precise affective meaning from the comparison of numerical information and therefore, used it more in their judgment and decision. On the other hand, for incidental affect, previous research showed that numeracy attenuates the

biasing effect of incidental affect on judgment and decision-making (Västfjäll, Peters, & Starmer, 2011). Based on this, I predicted numeracy would moderate both effect of integral affect and incidental affect on the attractiveness judgment, but in the opposite direction: higher numeracy would increase the effect of integral affect and reduce the effect of incidental affect on the attractiveness judgment (*Hypothesis 2A and 2B*).

Furthermore, I also tested if there was an interaction effect between integral affect and incidental affect on the attractiveness judgment (*Hypothesis 2C*). According to the integrative model suggested by Västfjäll and his colleagues (2016), the effect of incidental affect on judgment and decision-making is contingent on the intensity of integral affect. Specifically, as affective responses of integral affect are less intense, incidental affect would have a larger influence on judgment and decision-making. Based on this framework, I predicted that the effect of incidental effect on the attractiveness judgment would be moderated by the precision of integral affect. Therefore, the following hypotheses were tested in Study 2.

Hypothesis 2A: Participants who feel more positive about the gamble would rate the gamble more attractive than participants who feel less positive. Also, this effect would be moderated by the numeracy level of participants.

Hypothesis 2B: Participants who are induced to feel positively irrelevant to the gamble would rate the gamble more attractive than participants who are induced to feel negatively. Also, this effect would be moderated by the numeracy level of participants.

Hypothesis 2C: Participants who feel more positive about the gamble would be less influenced by the experimentally induced incidental affect in the attractiveness judgment of the gamble.

As in Study 1, the same gamble and the attractiveness judgment task was used in Study 2. The design of Study 2 was similar to Study 1 except for four components. First, the experiment of Study 2 was designed as a 2 (gamble condition: with loss vs. with no loss) x 2 (mood induction: positive mood vs. negative mood) between-participant experiment. Participants were randomly assigned to one of the four conditions. Second, participants' numeracy level was measured. Third, the procedure for incidental affect manipulation using affective sound stimuli was included. Lastly, participants were asked to rate integral affect about the 9000-won gain, the information which was included in both conditions, as well as the gamble itself. This change was made because how participants feel about the same information included in both conditions would be a more accurate parameter of the change in participants' integral affect.

1 Method

1.1 Participants

Ninety-two undergraduate students who took introductory psychology courses at Seoul National University participated in the experiment. They were recruited using a course credit participant pool. The average age was 20 years (SD = 1.91), and 52 participants were female.

1.2 Procedures

When they arrived in the laboratory, all participants were first asked to read and sign the first consent form. To avoid hypothesis guessing, participants were told that the current experiment was conducted to investigate individual differences in information processing in regard to everyday judgment and decision-making.

They were also told that each participant would be randomly assigned to a range of different judgment and decision-making tasks. After they

signed the first consent form, they were seated in front of a computer separately. Each seat was compartmented so that participants could not see to which experimental condition other participants were assigned.

Once they were seated, they were instructed to wear a headset in case the task they were assigned to included sound stimuli. Before the experiment began, they were given a written instruction that they would randomly participate in one of the judgment and decision-making tasks. First, they answered to a numeracy scale. Then, they listened to a series of affective sound clips for a minute. At the end of each clip, they were asked to rate how pleasant or negative the sound that they just heard. After listening to the sound clips, they were asked to answer to PANAS. Subsequently, the description of the gamble that each participant was assigned to was presented on the screen. After reading the description of the gamble, they judged how attractive the gamble. They also reported how they felt about the gamble and the 9000-won gain and how clearly the feeling was. Lastly, they provided demographic information. Once all participants completed the task, they were debriefed with the true research hypothesis. After the debriefing, they were asked if they still agreed with their data to be used for analysis and signed the second consent form once again. The experiment was conducted for 30 minutes.

1.3 Materials and measures

1.3.1 Numeracy (Appendix 2)

Objective Numeracy Scale (ONS; Weller et al., 2013) was used to assess participants' numeracy. The scale is an abbreviated numeracy test, which consists of 8 items of word problems of probabilistic and mathematic items (see Appendix 2). Each item was scored as correct or incorrect and the number of correct responses were calculated and used as a numeracy measure. The numeracy construct of this scale was validated using a Rasch

Analysis and resulted in correlating substantially with the objective measure as well as with subjective measure (Weller et al., 2013). The measure was translated and administered in Korean.

1.3.2 Affective sound clip

The sound clips used to induce positive and negative incidental affect were selected from IADS-2 (International Affective Digitized Sounds 2nd Edition; Bradley & Lang, 2007). The IADS is a set of acoustic affective stimuli for experimental investigations of affect. 20 stimuli (10 stimuli for each valence) were selected from the database of 167 naturally occurring sounds based on their valence. Each clip was 6-second long and participants listened to 10 clips. At the end of each clip, participants were asked to rate how pleasant or negative the sound on a 7-point Likert scale (from -3 = "Very negative" to 3 = "Very positive").

1.3.3 Mood induction check (Appendix 3)

PANAS (the Positive and Negative Affect Schedule; Watson & Tellegen, 1988) was used to check whether mood induction was successful. PANAS is a self-report questionnaire is a 20-item scale which consist of affective words (10 items for each valence) to measure both positive and negative affect. Participants were asked to report how they felt in general by rating how they feel for each item on a 5-point Likert scale ranging from 1 (very slightly) to 5 (extremely). In the current study, the Korean version of PANAS was used, which was revalidated by Park and Lee (2016).

1.3.4 Attractiveness judgment task (Appendix 1)

The same attractiveness judgment task from Study 1 was used in Study 2. This task was originally adapted from past research (Bateman et al., 2007; Peters et al., 2006; Slovic et al., 2002). The task was translated in Korean, and U.S. dollar in the original task was changed to Korean won

(i.e., 9 dollars to 9000 won and 5 cents to 50 won). In the loss condition, participants were asked to rate the attractiveness of the gamble with the 9000-won gain and the 50-won loss. In the no-loss condition, participants were asked to rate the attractiveness of the gamble with the 9000-won gain without any loss. They reported on a 21-point Likert scale (from 0 = "Not at all attractive" to 20 = "Extremely attractive").

1.3.5 Manipulation Check for Integral Affect (Appendix 4)

Participants were asked to report how they feel about the gamble and its attributes (i.e., integral affect) and how precise is the feeling (i.e., affective precision) separately. Integral affect was rated on a 7-point Likert scale (from -3 = "Very negative" to 3 = "Very positive") and affective precision was rated on a 7-point Likert scale (from 0 = "Completely unclear" to 6 = "Completely clear").

2 Results

For analysis, the categorical variables were coded as follows: gamble condition was coded as the no-loss condition = 0 and the loss condition = 1, the incidental affect manipulation as the negative affect conditions = 0 and the positive affect condition = 1. The continuous variables were coded as follows: numeracy was coded from 1(lowest) to 8(highest); the responses for integral affect (and its affective precision) about the gamble were coded as from 1 = "Very negative" ("Completely unclear") to 7 = "Very positive" ("Completely clear"); the attractiveness rating of the gamble were coded as from 1 = "Not at all attractive" to 21 = "Extremely attractive".

Table 2 provides means, standard deviations, and correlations between variables. As expected, the gamble condition had a significant positive correlation with integral affect and attractiveness rating ($r = .40, .36,$ *respectively*). Numeracy also had a significant positive correlation with

integral affect and attractiveness rating (*r = .32, .45, respectively*). There was also a significant positive correlation between integral affect and attractiveness rating (*r = .74*).

Table 2. Means, Standards Deviations, and Correlations between Variables

	Variable	Mean	SD	1	2	3	4	5
1	Gamble condition	.53	.50	—				
2	Numeracy	6.50	1.66	.15	—			
3	Incidental Affect	.43	.50	.03	-.18	—		
4	Integral Affect	5.22	1.62	.40***	.32***	.04	—	
5	Attractiveness Rating	13.92	6.23	.36***	.45**	.11	.74***	—

Note. The correlation between gamble condition, incidental affect is tetrachoric.

2.1 Effect of integral affect-numearcy interaction on attractiveness judgment

Hypothesis 2A predicted that participants who feel more positive about the gamble would rate the gamble more attractive than participants who feel less positive. First, I tested if participants in the loss condition felt more positive about the gamble than participants in the no-loss condition in order to see if integral affect manipulation was successful. The result of an one-way analysis of variance indicated the significant effect of the gamble condition on integral affect about the gamble (*F(1, 90) = 18.33, p < .001,* η_p^2 *= .169*). Participants in the loss condition (*M = 5.84, SD = 1.16*) feeling more positive about the gamble than participants in the no-loss condition (*M = 4.51, SD = 1,78*).

Second, as in Study 1, I examined if integral affect about the gamble mediated the effect of the gamble condition on the attractiveness rating. To examine the mediation effect of integral affect, I also used the mediation PROCESS model with bootstrapping (*Model 4*; Hayes, 2018; Preacher & Hayes, 2004). I estimated the indirect effect of the gamble condition on the attractiveness rating through integral affect about the gamble with 1000 bootstrapping samples for a 95% confidence interval. The coefficients of the estimated model (Model B; see Figure 5) are shown in Table 3.

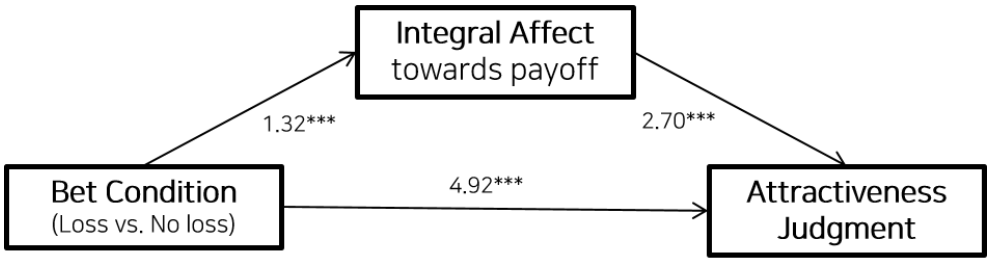

Figure 5. Results from the mediation analysis of Study 2
*Asterisks indicate significance (*** p <.001)*

Table 3
Coefficient Estimates for Model B (Mediation Model)

Model B	**b**	**SE**	**t**	**p**	**CI (lower)**	**CI (upper)**
X → M	1.33	.31	4.22	.000	.70	1.95
M → Y	2.70	.26	10.51	.000	2.19	3.21
X → Y (c)	4.92	1.22	4.05	.000	2.51	7.34
X → Y (c')	1.34	.96	1.40	.164	-.56	3.25
X → M → Y	3.58	.91			1.87	5.49

Note. X = Gamble condition, M = Integral affect, Y = Attractiveness rating

In Step 1 of the mediation analysis, the regression of the gamble condition on the attractiveness rating, ignoring the mediator, was significant ($b = 4.92, t(90) = 4.09, p < .001$). Step 2 showed that the regression of the gamble condition on the mediator (integral affect about the 9000-won gain) was also significant ($b = 1.33, t(90) = 4.28, p < .001$). Step 3 showed that the regression of the mediator, controlling for the gamble condition, was also significant ($b = 2.70, t(89) = 9.12, p < .001$). Step 4 revealed that, controlling for the mediator, the gamble condition was not a significant predictor of the attractiveness rating ($b = 1.34, t(89) = 1.40, p = .16$). These results indicated that integral affect participants had about the 9000-won gain fully mediated the effect of the gamble condition.

Lastly, I tested if participants' numeracy, a cognitive ability to process number, would moderate the mediation relationship between the gamble condition, integral affect about the gamble, and the attractiveness rating. To test the moderated mediation model, I used the moderated mediation PROCESS model with bootstrapping (*Model 7*; Hayes, 2018; Preacher & Hayes, 2004). Specifically, I estimated the conditional indirect effect of the gamble condition on the attractiveness rating through integral affect with the numeracy level (higher vs. lower) as a moderator, by generating a 95% confidence interval with 1000 bootstrapping samples. . The coefficients of the estimated model (Model C; see Figure 6) are shown in Table 4.

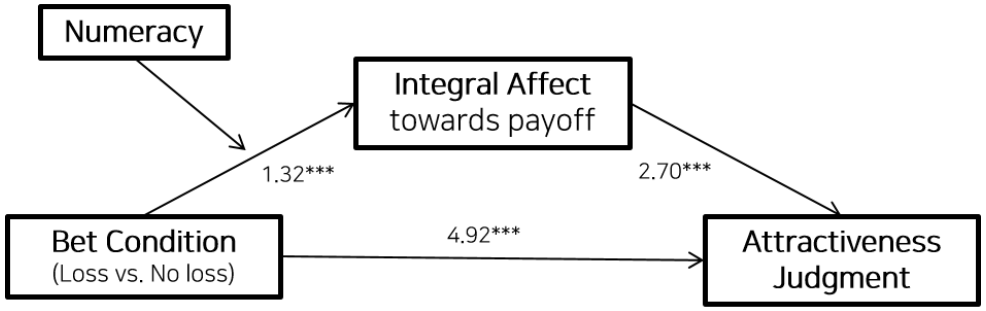

Figure 6. Results from the moderated mediation analysis of Study 2
*Asterisks indicate significance (*** p <.001)*

Table 4
Coefficient Estimates for Model C (Moderated Mediation Model)

Model C	b	SE	t	p	CI (lower)	CI (upper)
X → M	2.02	.50	4.06	.000	1.03	3.00
M → Y	2.70	.26	10.51	.000	2.19	3.21
X → Y (c')	1.34	.96	1.40	.164	-.56	3.25
X*W → M	-1.29	.61	-2.12	.037	-2.49	-.08
Conditional Mediation for Higher Numerate	1.97	.95			-.02	3.87
Conditional Mediation for Lower Numerate	5.44	1.43			2.66	8.32
Index of Moderated Mediation	-3.47	1.70			-7.13	-.34

Note. X = Gamble condition, M = Integral affect, W = Numeracy, Y= Attractiveness rating

The indirect effect of the gamble condition on the attractiveness rating through integral affect was significantly decreased when participants were higher numerate (*b = 1.97; 95% CI = .04, 3.80*) compared to when participants were less numerate (*b = 5.44; 95% CI = 2.59, 8.40*), as indicated by the significant interaction between the gamble condition and

the numeracy level of participants ($b = -1.29$, $t = -2.12$, $p < .05$; Figure 7, 10). These results supported Hypothesis 2A. That is, participants in the loss condition judged the gamble more attractive as a result of having more positive integral affect, compared to participants in the no-loss condition. The effect of integral affect on the attractiveness rating was significant in both the higher numerate and the less numerate. However, the difference of the attractiveness ratings between the gamble conditions was significant only in the less numerate. These results indicated that the less numerate was more likely to be affected by context in constructing how they felt about the target of the judgment and, in turn, making the judgment. These results showed the opposite compared to those of previous studies (Peters et al., 2006), in which there was a significant difference between the gamble conditions only in the higher numerate.

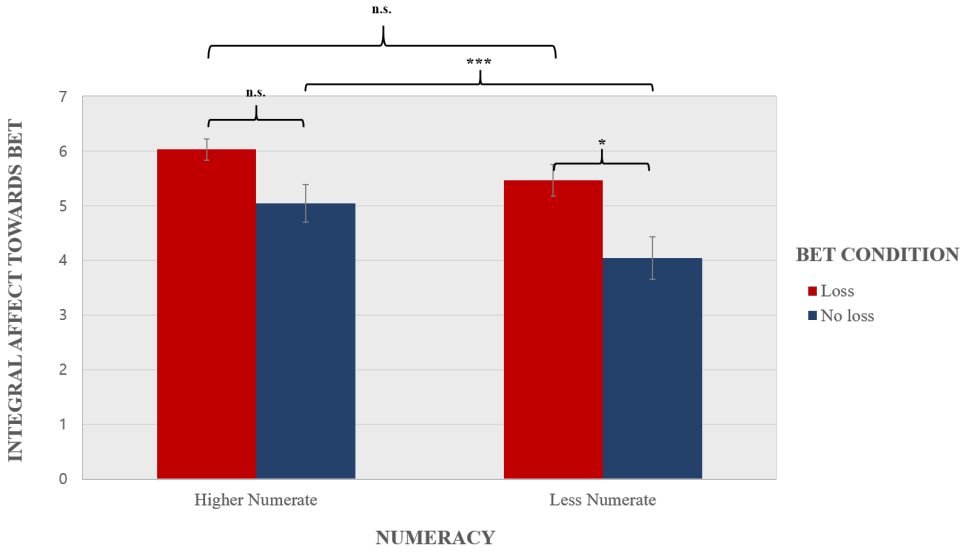

Figure 7. Report on integral affect about the gamble by the gamble condition (loss vs. no loss) and the numeracy level (higher vs. lower).
Error bars indicate standard error of the mean.

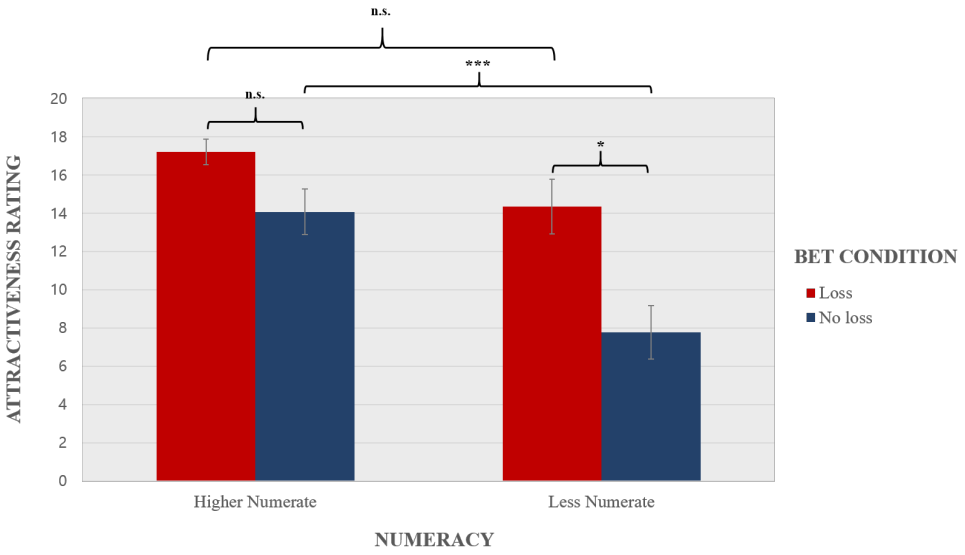

Figure 8. Report on the attractiveness judgment by the gamble condition (loss vs. no loss) and the numeracy level (higher vs. lower).
Error bars indicate standard error of the mean.

2.2 Effect of incidental affect-numeracy interaction on attractiveness judgment

Hypothesis 2B predicted that participants who are induced to feel positively irrelevant to the gamble would judge the gamble more attractive than participants who are induced to feel negatively. First, in order to check if the incidental affect manipulation was successful, I examined if participants in the positive incidental affect manipulation condition reported feeling more positive and less negative than participants in the negative condition, by comparing PANAS measures (Positive Affect Score (PA) and Negative Affect Score (NA), separately). The results of an one-way analysis of variance with PA as the dependent variable indicated participants in the positive condition ($M = 2.56, SD = .92$) reported feeling more positively in general than participants in the negative condition ($M = 2.19, SD = .73, F(1, 90) = 4.67, p < .05, \eta_p^2 = .05$). The results of an one-way analysis of variance with NA as the dependent variable indicated participants in the positive condition ($M = 1.81, SD = 1.03$) reported feeling less negatively in general about the gamble than participants in the negative condition ($M = 2.34, SD = .98, F(1, 90) = 6.50, p < .05, \eta_p^2 = .07$). That is, participants who listened to the set of positive sound clips reported feeling more positive and less negative than the participants who listened to the negative sound clips, revealing that the manipulation of integral affect was successful.

Second, I tested if participants in the positive incidental affect manipulation condition judged the gamble more attractive than participants in the negative condition. The result of an one-way analysis of variance indicated no significant effect of the incidental affect condition (positive vs. negative) on the attractiveness rating ($F(1, 90) = 0.96, p = .33, \eta_p^2 = .011$). This result indicated a possibility that the incidental affect manipulation was not entirely effective, even though there was a significant difference in PANAS measures. Therefore, I considered a possibility that the pre-existing

differences between participants' naturalistic moods might predict the attractiveness rating. According to previous research, naturalistic moods might, to some degree, be resistant to the affective manipulation procedures (Bohn-Gettler & Rapp, 2011; Scherrer & Dobson, 2009). Thus, I used PA and NA score of PANAS measures to predict the attractiveness rating.

A regression using PA score as the independent variable and the attractiveness rating as the dependent variable revealed that PA score marginally predicted the attractiveness rating ($F(1, 90) = 3.04$, $p = .08$, $R^2 = .03$). NA did not significantly predict the attractiveness rating ($p = .28$). The results suggested that how positive participants felt irrelevant to the gamble might influence how attractive participants found the gamble. Specifically, participants having more positive incidental affect judged the gamble more attractive ($b = 1.35$, $t = 1.74$, $p = .08$) than participants who had less positive incidental affect.

Lastly, I tested if the effect of positive incidental affect on the attractiveness rating was modulated by participants' numeracy level. To examine the modulation effect of numeracy, I used the moderation PROCESS model with bootstrapping (*Model 1*; Hayes, 2018; Preacher & Hayes, 2004). I estimated the conditional effect of the gamble condition on the attractiveness rating with the numeracy level as a moderator, by generating a 95% confidence interval with 1000 bootstrapping samples. The coefficients of the estimated model (Model D) are shown in Table 5.

Table 5
Coefficient Estimates for Model D (Moderation Model)

Model 4	b	SE	t	p	CI (lower)	CI (upper)
X → Y	.95	.68	1.39	.168	-.41	2.30
W → Y	1.59	.34	4.62	.000	.90	2.27
X*W → Y	-.7403	.39	-1.91	.059	-1.51	.03
Conditional Effect for Higher Numerate	2.17	1.00	2.18	.032	.19	4.16
Conditional Effect for Mean	.95	.68	1.39	.168	-.41	2.30
Conditional Effect for Lower Numerate	-.17	.83	-.20	.843	-1.82	1.49

Note. X =Positive incidental affect, W = Numeracy, Y = Attractiveness rating

The analysis revealed that the interaction between positive incidental affect and numeracy was marginally significant (*b = -.74, t(88) = -.191, p = .059)*, as well as numeracy (*p <0.001*) independently. Specifically, the effect of incidental affect on the attractive judgment was only significant in participants with lower numeracy (whose numeracy was 1SD below the mean) and not significant in participants with higher numeracy (whose numeracy is 1SD below the mean) or participants with mean-level numeracy (Figure 9). Therefore, Hypothesis 2B was supported. PA and NA scores were used in the subsequent analysis for Hypothesis 2C.

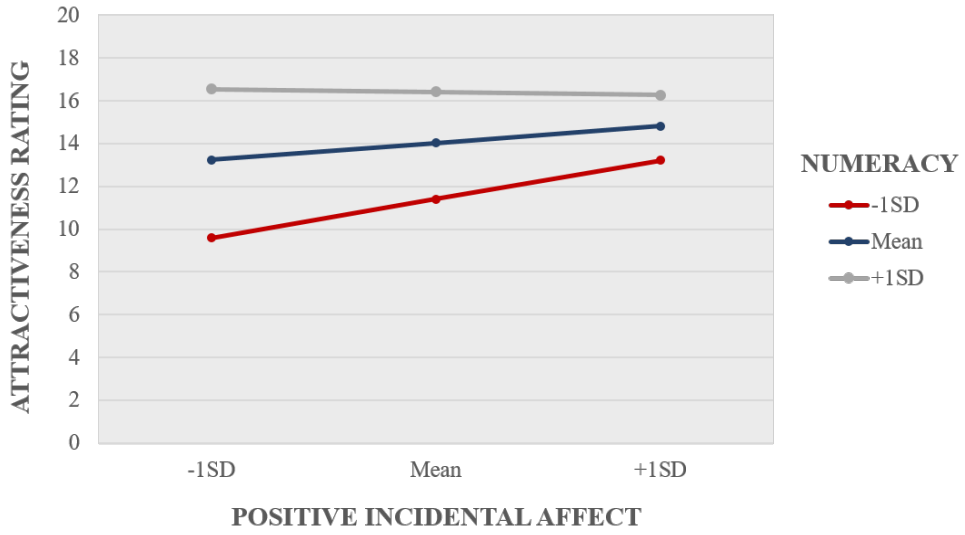

Figure 9. Moderation effect of numeracy on the relationship between positive incidental affect on the attractiveness judgment

2.3 Interaction effect of integral and incidental affect on attractiveness judgment

Hypothesis 2C predicted that participants who feel more positive about the gamble would be influenced less by the experimentally manipulated incidental affect in their judgment. I tested if the effect of positive incidental affect on the attractiveness rating was modulated by participants' integral affect. A regression using PA score, integral affect about the gamble, and their interaction term as the independent variables and the attractiveness rating as the dependent variable did not reveal a significant interaction between PA score and integral affect on the attractiveness rating ($F(3, 88) = 36.67$, $p = .97$, $R^2 = .54$). Hypothesis 2C was not supported.

Chapter 4. General discussion

The current study examined the following questions: 1) how integral affect and incidental affect differently interact with numeracy, the cognitive ability to process probabilistic and numeric information, 2) the differential interaction effect between each type of affect and numeracy on a attractiveness judgment task of a simple gamble. For this investigation, an adapted attractiveness judgment task was used where participants were asked to evaluate the attractiveness of a simple gamble (Slovic et al., 2002) with two different conditions (with a loss vs. without a loss). For integral affect, the primary prediction was that the higher-numerate participants would have more positive integral affect about the gamble, and in turn, rate the gamble more attractive than the less-numerate participants. For incidental affect, it was predicted that the higher-numerate participants would less affected by incidental affect in the attractiveness judgment of the gamble than the lower-numerate participants. In order to examine the predictions above, two experiments were conducted. In both studies, integral and incidental affect were experimentally manipulated. Integral affect was manipulated by having participants rate the attractiveness of the gamble of two different conditions: with a loss or without a loss, a novel method investigated in Study 1 and explained below. Incidental affect was manipulated by having them listen to positive or negative affective sound stimuli.

In Study 1, I examined whether the different gamble conditions (loss vs. no-loss) could be used as an induction method to manipulate participants' integral affect about the gamble. The results indicated that the different gamble conditions elicited a change in participants' integral affect about the gamble. Specifically, participants in the loss condition reported feeling more positive about the gamble than participants in the no-loss conditions. Based on the results of Study 1, the procedure was

used in Study 2 as a manipulation method of integral affect. Furthermore, these results, which demonstrated the mediating effect of participants' integral affect about the gamble on the relationship between the gamble condition and the attractiveness rating, support the findings of previous studies on the affect heuristics. These results showed that people use how they feel about a target of a judgment as a heuristic when making judgments, as predicted by the theory of the affect heuristics (Slovic et al., 2002)

In Study 2, I examined how integral and incidental affect interacted with numeracy and how their interaction differentially influenced the attractiveness rating of the gamble used in Study 1. Numeracy was selected as a relevant cognitive ability which is required, based on previous research (Traczyk et al., 2018; Västfjäll, Peters, & Starmer, 2011; Peters et al., 2006), to process numbers and probabilities in the judgment task. I also tested if there was an interaction effect between integral affect and incidental affect on attractiveness judgment -- whether the effect of incidental effect would be moderated by the degree of integral affect. For integral affect, the results indicated that participants who rated the gamble with a loss, as a result of of having more positive integral affect, than participants who rated the gamble without a loss. This effect was significant in both the higher-numerate and lower-numerate groups, but the difference was bigger in the lower-numerate group than in the higher-numerate group. The results can be interpreted to mean that the lower-numerate participants were more likely to be affected by context. For incidental affect, the results suggested that how positively participants felt irrelevant to the gamble influenced how attractive participants rated the gamble. Furthermore, this effect of positive incidental affect on the attractiveness rating was significant only in the less-numerate group. However, the expected interaction effect between integral and incidental

affect on the attractiveness judgment was not found. Taken together, the current study provided evidence for how different types of affect could differentially influence our judgment. Further, it also demonstrated that the effect interacted with our cognitive ability to process the relevant information for a given judgment.

With the findings from Study 1 and 2, the current study has the following implications. First, the current study provided additional evidence to the growing body of research on the differential effect of different types of affect on judgment. The current study contributed to delineate the nuanced role affect plays by distinguishing affect by its source and investigating their differential influences. The findings suggested that the influence of affective experience is far too complicated to determine whether affect enhances or hinders our judgment and decision-making. Rather, it demonstrated that the effect is individual- and context-specific. Second, the current study adds more evidence to the literature of affect-cognition interaction by demonstrating that affective influences on the process of judgment and decision-making are closely intertwined with cognitive processes. Third, one of the contributions of the current study is to suggest a novel way to manipulate integral affect using a simple rating task. Finally, as a whole, the study demonstrates the importance of appropriate contexts in which information is presented for judgment and decision-making by showing that the same information is evaluated differently depending on how it is presented.

Limitation and future research

For future research, the following points can be considered. First, the effect of other dimensions of affect such as arousal and dominance should be considered. The current study only examined the effect of valence of integral and incidental affect. Previous research demonstrated that each

dimension of affect has a different influence on the judgment and decision-making processes. Therefore, future studies need to investigate the distinctive effects of arousal and dominance of affect as well.

Second, another limitation of the current study is that integral affect about the bet was not manipulated as positive or negative, but only as 'more positive' or 'less positive,' in contrast to incidental affect which was induced as positive or negative. This limitation was due to the nature of the manipulation method. Even though participants rated bets with different conditions (with loss or without loss), the expected values of both conditions were both above 0. Therefore, the whole spectrum of the valence of integral affect should be considered in future research.

Third, the future research needs to investigate alternative explanations for the effect of numeracy and other factors as covariate such as emotional understanding ability (Yip & Côté, 2013). Yip & Côté (2013) showed that emotion-understanding ability, an ability consisting of emotion intelligence (Mayer & Salovey, 1997) could explain the reduced biasing effects of incidental anxiety by determining that such type of anxiety is irrelevant to current decisions.

Lastly, the different effects of discrete emotions can be taken into consideration in future research. It has been consistently documented that discrete emotions exert a different impact on judgment and decision-making (Lerner, Li, Valdesolo, & Kassam, 2015). For example, even though fear, disgust, and anger are all categorized as negative affect, the experience of anger tends to trigger actions, while that of sadness does not. Therefore, even though participants were induced to have the same negative affect, it is also possible that they felt different discrete emotions and that might have impacted their judgment differently

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국문 초록

지난 20여 년 동안의 정서 연구의 발전을 통해 정서와 인지의 상호작용과 그 상호작용이 판단과 의사결정에 미치는 영향에 대한 많은 연구가 이루어져 왔다. 하지만 해당 연구들은 서로 상충된 결과를 보고하고 있다.

본 연구에서는 정서를 판단과 의사결정의 대상과의 관계에 따라 '대상 관련 정서 (주어진 판단과 의사결정의 대상에 대해 느끼는 정서)'와 '부수적 정서 (주어진 판단과 의사결정의 대상과 관련이 없는 정서)'로 구분하였다. 이처럼 정서를 두 가지 종류로 구분하고, 두 정서가 수 정보 처리가 요구되는 간단한 경제적 판단 과제에 미치는 영향을 탐색하였다. 구체적으로 두 정서가 해당 경제적 판단 과제의 정보를 처리하는데 요구되는 수 정보 처리 능력인 수리력과 상호 작용하는 방식의 차이를 살펴보고, 그 차이가 판단에 미치는 영향을 탐색하였다.

위와 같은 연구를 위해 본 연구에서는 대상 관련 정서와 부수적 정서를 모두 실험적으로 조작하였다. 대상 관련 정서를 직접 조작한 선행 연구가 부재하여, 실험 1에서는 대상 관련 정서를 직접 실험적으로 조작할 수 있는 방법을 탐색하였다. Slovic과 그의 동료들(2002)이 사용한 내기 매력도 판단 과제를 활용하였는데, 본 과제에서 참여자들은 보상은 동일하나 조건에 따라 약간의 손실이 발생할 수 있는 내기 과제의 매력도를 평가하였다 ("7/36의 확률로 9달러를 얻거나 29/36의 확률로 아무것도 얻지 못함" 혹은 "7/36의 확률로 9달러를 얻거나 29/36의 확률로 5센트를 잃음").

실험 1에서는 이 과제를 활용하여 참여자들이 참여하는 조건에 따라 내기에 대해서 느끼는 정서(대상 관련 정서)가 달라진다는 것을 확인하였다. 구체적으로 약간의 손실이 수반된 조건의 내기를 평가한 참가자들이 내기에 대해 더 긍정적인 대상 관련 정서를 느끼는 것으로

나타났다. 그 뿐만 아니라 내기에 대한 대상 관련 정서가 내기의 조건이 내기에 대한 매력도 판단에 미치는 영향을 부분적으로 매개한다는 것을 확인하였다. 이에 따라 해당 과제를 실험 2의 매력도 판단 과제이자, 참여하는 과제의 조건을 다르게 하는 것을 대상 관련 정서를 조작하는 방법으로 활용하였다.

실험 2에서는 실험 1에서 검증한 내기 과제의 조건을 활용한 대상 관련 정서 조작 방법과 정서적 음성 자극을 활용한 부수적 정서 조작 방법을 사용하여 두 정서를 직접 조작하였다. 본 실험에서는 이와 같은 실험 방법을 사용하여 두 정서가 판단 과제에 필요한 인지 기능인 수리력과 어떻게 상호 작용하는지, 그 상호 작용이 매력도 판단에 어떠한 영향을 미치는지 살펴보았다. 대상 관련 정서와 관련하여서는, 수리력이 높은 사람일수록 판단 대상인 내기의 매력도를 더 높게 평가했고, 이는 수리력이 높은 사람들이 내기에 대해 느끼는 대상 관련 정서가 더 긍정적이기 때문인 것으로 나타났다. 이와 대조적으로, 부수적 정서와 관련하여서는, 수리력이 낮은 사람이 판단 대상인 내기의 매력도를 평가함에 있어 고려하지 않아야 할 부수적 정서의 영향을 받는 것으로 나타났다. 대상 관련 정서와 부수적 정서의 상호작용은 나타나지 않았다.

본 연구는 이론적으로만 제시된 대상 관련 정서와 부수적 정서의 차이에 대한 경험적 근거를 제공하고, 다른 유형의 정서가 인지와 상호작용하는 서로 다른 방식이 판단과 의사결정에 미치는 영향에 대한 이해를 증진했다는 의의를 갖는다.

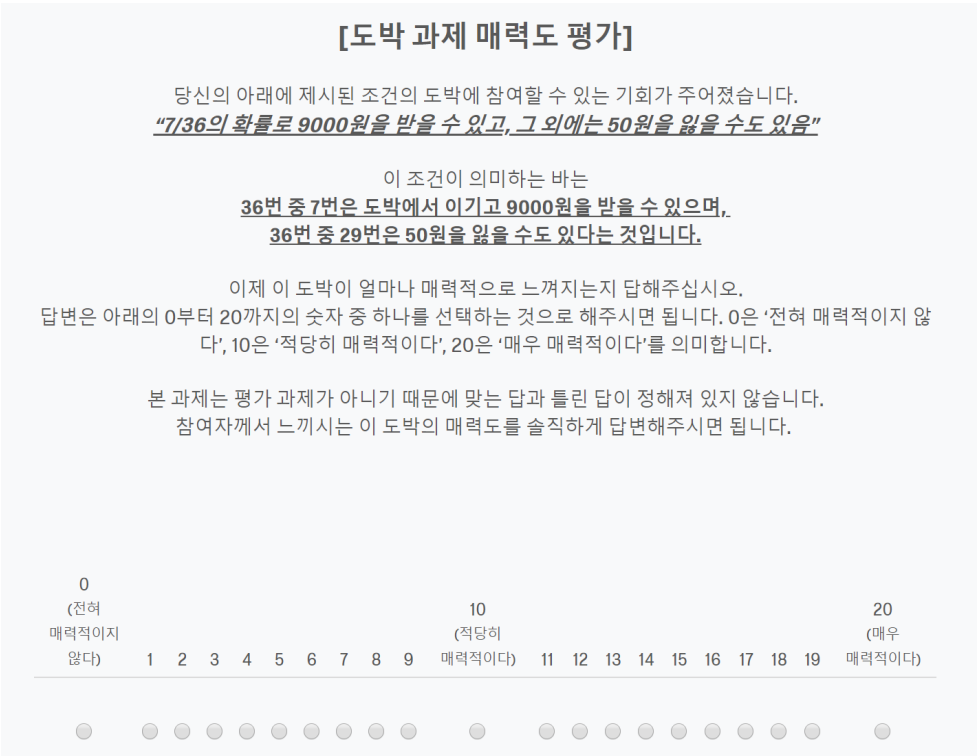
주요어: 정서-인지 상호작용, 대상 관련 정서와 부수적 정서, 수리력, 판단과 의사결정

학 번: 2017-25728

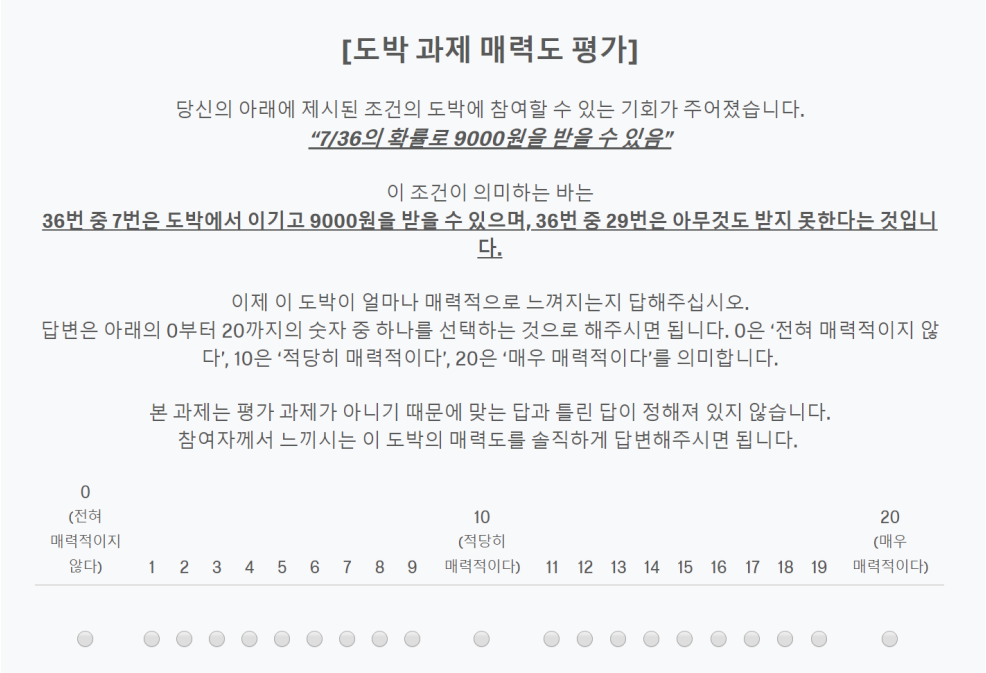
Appendix

Appendix 1: Attractiveness Judgment Task

Loss Condition



No-loss condition



Appendix 2: Objective Numeracy Scale

1. 1 부터 6 까지의 숫자가 적혀 있는 정육면체 주사위를 1000 번 던진다고 가정하자. 1000 번 중 짝수는 몇 번 나올 것으로 예상하는가?

   정답: _____번

2. 'A 복권'을 샀을 때 10,000 원의 상금을 받을 가능성은 1%이다. 1000 명이 각각 한 장씩 'A 복권'을 구매했을 때, 10,000 원의 상금을 받게 될 사람은 몇 명일까?

   정답: _____명

3. 어떤 내기 게임에서, 경품으로 자동차를 탈 확률은 1000 중 1 이다. 이 내기 게임에서 구매한 표 중 몇 퍼센트가 경품으로 차를 타게 될까?

   정답: _____퍼센트

4. 만약 어떤 질병에 걸릴 확률이 10%라면, 1000 명 중 몇 명의 사람들이 이 질병에 걸리게 될까?

   정답: _____명

5. 만약 어떤 질병에 걸릴 가능성이 100 중 20 이면, 이 수치는 이 질병에 걸릴 확률이 _____퍼센트라는 것과 같다.

   정답: _____ 퍼센트

6. 당신의 친구가 X 선을 이용한 유방암 검진 방법인 유방조영술을 받았다. 의사는 선행 연구 결과들에 근거하여 다음과 같은 사실을 알고 있다: 당신의 친구 같은 여성 100 명 가운데, 10 명이 종양이 있고, 90 명은 그렇지 않다. 종양을 갖고 있는 10 명이 유방조영술을 받는다고 했을 때, 유방조영술을 통해 9 명은 종양이 갖고 있다는 올바른 진단을 받고, 1 명은 종양이 없다는 잘못된 진단을 받는다. 종양이 없는 90 명의 여성이 유방조영술을 받는다고 했을 때, 유방조영술을 통해 80 명은 종양이 없다는 올바른 진단을 받고, 10 명은 종양이 있다는 잘못된 진단을 받는다. 아래의 표는 이 같은 정보를 표로 나타낸 것이다. 당신의 친구가 유방조영술을 받은 결과,

결과가 양성(종양이 있다는)으로 나왔다고 상상해보자. 당신의 친구가 실제 종양을 갖고 있을 가능성은 얼마나 될까?

	검사 결과 양성	검사 결과 음성	총합
실제 종양이 있음	9	1	10
실제 종양이 없음	10	80	90
총합	19	81	100

정답: _____ 중(out of) _____

7. 야구방망이와 야구공의 가격이 총 1,100 원이다. 야구방망이의 가격은 야구공의 가격보다 1000 원 비싸다. 야구공의 가격은 얼마인가?

   정답: _____원

8. 호수 위에 연꽃 잎들이 한 무리 떠있다. 매일매일, 연꽃 잎들 무리의 크기가 두배로 늘어난다. 만약 이 연꽃 잎 무리가 호수 전체를 뒤덮는데 48 일이 걸렸다면, 호수의 반을 덮는 데는 얼마나 걸렸을까?

   정답: _____일

Appendix 3: Positive and Negative Affect Schedule (PANAS)

한국판 PANAS 척도

다음에 나오는 각 단어는 감정이나 기분을 기술한 것입니다. 각 단어를 읽고, 현재를 포함한 지난 일주일 동안 당신이 느끼는 기분의 정도를 가장 잘 나타낸 곳에 “V” 표시를 해 주십시오.

문항	내용	전혀 그렇지 않다	약간 그렇다	보통 정도로 그렇다	많이 그렇다	매우 많이 그렇다
1	흥미로웠다					
2	짜증스러웠다					
3	괴로웠다					
4	맑은 정신이었다					
5	신이 났다					
6	부끄러웠다					
7	화가 났다					
8	고무되었다					
9	강인했다					
10	긴장했다					
11	죄책감이 들었다					
12	확고했다					
13	겁이 났다					
14	주의 깊었다					
15	적대적이었다					
16	초조했다					
17	열정적이었다					
18	활기찼다					
19	자랑스러웠다					
20	두려웠다					

Appendix 4: Integral Affect Questionnaire

Study 1

해당 도박 과제에 대해 얼마나 긍정적 혹은 부정적으로 느끼나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정적) (매우 긍정적)

앞에서 답변한 정서가 얼마나 '명확하게(clearly)' 느껴지나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정확함) (매우 정확함)

Study 2

해당 도박 과제에 대해 얼마나 긍정적 혹은 부정적으로 느끼나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정적) (매우 긍정적)

앞에서 답변한 정서가 얼마나 '명확하게(clearly)' 느껴지나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정확함) (매우 정확함)

앞에서 제시된 도박 과제에서 '9000 원'을 얻는 부분에 대해 얼마나 긍정적 혹은 부정적으로 느끼나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정적) (매우 긍정적)

앞에서 답변한 정서가 얼마나 '명확하게(clearly)' 느껴지나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정확함) (매우 정확함)

앞에서 제시된 도박 과제에서 '7/36 의 확률로 이득을 얻을 수 있다'는 부분에 대해서 얼마나 긍정적 혹은 부정적으로 느끼나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정적) (매우 긍정적)

앞에서 답변한 정서가 얼마나 '명확하게(clearly)' 느껴지나요?

☐ -3 ☐ -2 ☐-1 ☐ 0 ☐ 1 ☐ 2 ☐ 3

(매우 부정확함) (매우 정확함)